

Appl. No. 10/694,717
Amdt. dated July 21, 2005
Reply to Office Action of May 27, 2005

REMARKS / ARGUMENTS

Claim Objections

As requested by the Examiner, in claim 1 the word "centre" has been corrected to read -- center --. However, the second Examiner's request to place the word -- the -- between "into which" and "input end of the LACDCF the optical signal is to be transmitted" is incorrect. The resulting sentence would make no sense. However, to make the sentence clearer, it has been corrected to read -- into said input end of the LACDCF the optical signal is to be transmitted from said few-mode fiber --. Also, in claim 2, lines 2, the typo "ia" has been corrected to -- is --.

Claim Rejections - 35 USC § 103

The Examiner has rejected claims 1-7, 9-11 and 13-16 under 35 U.S.C. 103(a) as being obvious over Fidric et al. U.S. Patent No. 6,434,302 B1 (Fidric) in view of White Published Application No. 2004/0197062 A1 (White).

This rejection is respectfully traversed for the following reasons.

The present application has been published under No. 2005/0094952 A1 and it is to this publication that reference will be made in discussing the issues raised by the Examiner.

First, let us re-state the main claim 1 of the present application as presently amended:

1. An optical coupler which comprises:
 - (a) a bundle of a plurality of multimode fibers having a few-mode fiber in the center, said few-mode fiber being a signal fiber through which an optical signal is transmitted;
 - (b) a large area core double clad fiber (LACDCF) having an inner cladding and an outer cladding with a lower refractive index, and having an end portion terminating with an input end the inner cladding of which has a predetermined

circumference, into said input end of the LACDCF the optical signal is to be transmitted from said few-mode fiber;

- (c) said bundle having a fused end portion with an output end having a periphery that fits within the circumference of the inner cladding of the input end of the LACDCF; and
- (d) said output end of the bundle being aligned and spliced with the input end of the LACDCF in such a way as to preserve fundamental mode transmission from the few-mode fiber to the LACDCF.

The first requirement of this claim is to have a bundle of a plurality of multimode fibers with a few-mode fiber in the center of the bundle that transmits a signal. This signal is then transmitted into a large area double clad fiber (LACDCF) and this is done by having the periphery of the bundle fit within the circumference of the inner cladding of the input end of the LACDCF and by aligning the output end of the bundle and splicing it with the input end of the LACDCF so as to preserve the fundamental mode transmission from the few-mode fiber to the LACDCF. As described in paragraph [0006] and [0007] of applicants' disclosure the LACDCF fiber is a double clad fiber with a large area core, namely a few-mode core.

The Examiner's statement that Fidric teaches the use of LACDCF is clearly incorrect. Fidric teaches coupling combinations that include multimode fibers to multimode fiber or fibers (MMF's/MMF(s)) or multimode fibers/single mode fiber to double clad fiber (MMFs/SMF/DCF) (c.f. Abstract; column 5, line 49; column 6, line 11; column 6, lines 27-28; column 6, line 46). Fidric also teaches coupling MMF/DCF which is done by side coupling of MMF fiber 30 to DCF fiber 10 (c.f. column 6, lines 57-66 and Fig. 8). Nowhere does Fidric teach a possibility of coupling to an LACDCF fiber or any use whatsoever of an LACDCF fiber. Thus, the Examiner has misinterpreted Fidric in this regard.

The Examiner is correct that Fidric teaches "an optical coupler...comprising a bundle of individually pre-tapered multimode fibers (MMF 30) with a single mode fiber (SMF 20)...that transmits a signal...". This has been acknowledged by the present applicants in paragraph [0006]

and paragraph [0013] where it is explained why such single mode coupling is not comparable to a few-mode fiber coupling.

On the other hand, the Examiner's statement that Fidric discloses using "another MMF (column 6, lines 10-16) that transmits a signal in between a symmetric array of MMFs (30)" is simply wrong. In column 6, lines 10-16 of Fidric, it is merely stated that one can make a multimode to multimode fiber coupler MMFs/MMF by removing the single mode fiber 20 shown in Fig. 6, and not by replacing it by another MMF that would carry a signal. In fact, an MMF cannot carry a signal at all. A signal is carried by a single mode or a fundamental mode in a few-mode fiber, while a multimode fiber has a large number of modes and is therefore not capable of carrying a single mode or a fundamental mode signal. The MMFs/MMF coupler in Fidric is merely intended to produce a multimode fiber 30 having a much larger NA than the NA of the individual multimode fibers.

Furthermore, the Examiner's statement that Fidric discloses "a large area core double clad fiber (LACDCF, 14)" is not understood. Reference 14 in Fidric is the inner cladding of a double clad (DCF) fiber 10 which has a core 12 and an outer cladding 14. Nowhere is it indicated or suggested or implied that core 12 is or can be a "large area core" namely a few-mode core. In fact, it is clearly stated that core 12 is a single mode core of the DCF 10 (c.f. column 4, line 58). Also, the Examiner's statement that Fidric teaches an alignment and splicing with the LACDCF "to preserve fundamental mode transmission from the bundle to LACDCF" (column 5, lines 16-19) is again clearly wrong and is again not understood. There is no reference in Fidric whatsoever to "fundamental mode" and in column 5, lines 16-19, there is simply reference to a reduction of the single mode fiber (SMF) cladding 24 in order to meet the diameter matching requirements of the DCF 10, and nothing else.

Regarding White, it teaches indeed a few-mode fiber and the present applicants have certainly acknowledged that such fibers are known in the art as indicated in paragraph [0012]. White provides for enhancing the inherent selectivity by appropriate cross-sectional index profile design of the fiber to discourage coupling with the fundamental mode (c.f. paragraph [0011] of White). There is absolutely nothing in White that would suggest or even hint at a possibility of end-to-end coupling of his few-mode fiber with an LACDCF fiber. Furthermore, the Examiner's statement that "Fidric and White are analogous art because they are from the

same field of endeavor, mode coupling of different mode fibers" is submitted to be erroneous since neither Fidric nor White relate to such mode coupling, as already explained above. Fidric discloses only a single mode transmission and White does not disclose any end-to-end coupling at all.

According to MPEP 2143, the basic requirement of a *prima facie* case of obviousness is that "...the prior art reference (or references when combined) must teach or suggest all the claim limitations". Furthermore, according to MPEP 2143.01, the prior art must suggest the desirability of the claimed invention.

It is respectfully submitted that by combining Fidric and White, neither of the above conditions has been met. Neither Fidric nor White suggest that a bundle of multimode fibers having a few-mode fiber in the center could be coupled end-to-end with an LACDCF. In fact, neither Fidric nor White even mention the large area core double clad fiber (LACDCF) in their disclosure or claims. It is true that in claims 1-4 Fidric claims a system that does not employ a single mode fiber in the middle, but it is simply because it is removed from the coupling and there is no suggestion or hint that it could be replaced by anything else.

With hindsight of applicants' disclosure, the Examiner has combined and modified Fidric and White so that they would somehow fit applicants' claim 1. This is not acceptable and applicants' claim 1 is therefore novel and patentable over the above combination.

Regarding claims 2 to 8, they all refer directly or indirectly to claim 1 and possess its patentable characteristics. Claim 9 defines the method of producing the coupler defined in claim 1 and is therefore also patentable for the same reason as claim 1. No such method is either taught or suggested in Fidric or White or in their combination, namely how to make such a coupler and preserve the fundamental mode transmission from the few-mode fiber to the LACDCF. Claims 10 to 20 all refer back to claim 9 directly or indirectly and possess its patentable characteristics.

Regarding the objection to claim 8 by adding Weidman U.S. Patent No. 5,664,037 to the combination, it is respectfully submitted that such combination is again improper. Weidman deals with side-by-side coupling, namely by heating the fibers in the coupling region and stretching them until they are suitably tapered and coupling is thereby achieved. The use of dummy fibers in such a combination would in no way suggest or make it obvious to use dummy

fibers in an end-to-end coupling, particularly of specific fibers, including a few-mode fiber to be coupled to the LACDCF. Even, however, if Weidman could be combined with Fidric and White, it is stated in the explanatory notes of MPEP 2143.01, "the fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness, unless the prior art also suggests the desirability of the combination (In re Mills, 916 F.2d 680, 16 USPQ 2d 1432, Fed. circ. 1990)."

There is certainly nothing in Weidman or in Fidric or in White that suggests the desirability of the combination claimed by the present applicants.

The allowance by the Examiner of claims 12 and 17-20 is acknowledged and these claims have been maintained.

In the Examiner's conclusion, he states that DiGiovanni et al. U.S. Patent No. 5,864,644 could be used instead of Fidric in the rejection which he has made. DiGiovanni patent has also been acknowledged in applicants' disclosure, paragraph [0006], and it is not relevant for the same reasons as the Fidric patent. The present application is distinguishable from both Fidric and DiGiovanni far more than those two patents are distinguishable from one another, and it is to be noted that Fidric was granted despite the citation of DiGiovanni as a prior art reference. This clearly shows that in this art, even minor modifications can lead to a patentable invention and the present application certainly constitutes a major advance over both Fidric and DiGiovanni.

In view of the above amendment and arguments, reconsideration and allowance of this application are solicited.

The Examiner is invited to call Applicant's agent if any questions remain following review of this response.

Respectfully submitted,



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